

AMENDMENTS TO THE CLAIMS

1. (Currently Amended) A contention arbitration apparatus for arbitrating an access contention caused when a plurality of application programs simultaneously attempt to access at least one physical device, ~~the said~~ contention arbitration apparatus comprising:

a resource information storing section for storing resource information which indicates a correspondence between at least one resource, which defines functions of ~~said the~~ at least one physical device, and at least one application program, which is allowed to use functions associated with ~~said the~~ at least one resource;

a device information storing section for storing device information which indicates a correspondence between a logic device, which defines functions specified by ~~said the~~ at least one application program which attempts to access ~~said the~~ at least one physical device, and ~~said the~~ at least one resource which defines functions required for implementing functions defined by the logic device;

a used resource recognizing section for recognizing a resource associated with the logic device specified by ~~said the~~ at least one application program by reference to the device information;

a resource access determining section for determining, by reference to the resource information, which application program is allowed to access the resource recognized by ~~the said~~ used resource recognizing section; and

a device access determining section for determining, based on a determination result provided by ~~the said~~ resource access determining section, whether the application program which has specified the logic device is able to access ~~said the~~ at least one physical device which implements the functions defined by the logic device.

2. (Currently Amended) The contention arbitration apparatus according to claim 1, wherein the resource information contains multiple access information which indicates whether to allow simultaneous accesses from a plurality of application programs, and

wherein when the simultaneous accesses from the plurality of application programs are allowed, ~~the said~~ resource access determining section allows-is operable to

allow the plurality of application programs to access the resource based on the multiple access information.

3. (Currently Amended) The contention arbitration apparatus according to claim 2, wherein ~~the~~ said resource access determining section ~~allows~~ is operable to allow the plurality of application programs to access the resource only when a prescribed condition is satisfied.

4. (Previously Presented) The contention arbitration apparatus according to claim 3, wherein the prescribed condition is that the plurality of application programs use the same scheme to implement a function provided by the resource.

5. (Currently Amended) The contention arbitration apparatus according to claim 1, further comprising an executing section for executing a device driver for controlling ~~said the~~ at least one physical device when ~~the~~ said device access determining section determines that ~~said the~~ at least one application program which has specified the logic device is allowed to access ~~said the~~ at least one physical device.

6. (Currently Amended) The contention arbitration apparatus according to claim 5, wherein ~~the~~ said executing section ~~sends~~ is operable to send an error message to ~~said the~~ at least one application program having specified the logic device when ~~the~~ said access determining section determines that ~~said the~~ at least one application is not allowed to access ~~said the~~ at least one physical device.

7. (Currently Amended) The contention arbitration apparatus according to claim 1, wherein ~~the~~ said resource access determining section ~~determines~~ is operable to determine which application program is allowed to access ~~said the~~ at least one physical device based on priorities of the plurality of application programs.

8. (Previously Presented) The contention arbitration apparatus according to claim 7, further comprising an application information storing section for storing information about the priorities of the plurality of application programs.

9. (Currently Amended) The contention arbitration apparatus according to claim 7, wherein the resource information contains additional information which indicates whether to grant an access right to an application program having provided an access indication first or last; and

wherein when the plurality of application programs have the same priorities, ~~the~~ said resource access determining section ~~determines-is operable to determine~~ which one of the application programs is to be granted the access right based on the additional information.

10. (Currently Amended) The contention arbitration apparatus according to claim 1, further comprising:

an application information storing section for storing, as application information, a correspondence between a determination result obtained by ~~the~~ said device access determining section and the plurality of application programs; and

an executing section for executing a device driver for controlling ~~said-the~~ at least one physical device,

wherein when an access start indication is provided by an application program to specify the logic device, ~~the~~ said device access determining section ~~determines-is~~ operable to determine whether the application program is able to access ~~said-the~~ at least one physical device and ~~stores-store~~ a determination result into ~~the~~ said application information storing section; and

wherein when an access indication is provided after the access start indication, ~~the~~ said executing section ~~refers-is operable to refer~~ to the application information stored in ~~the~~ said application information storing section to determine whether the application program is able to access ~~said-the~~ at least one physical device.

11. (Currently Amended) The contention arbitration apparatus according to claim 10, wherein when an access indication is provided by an application program which is not able to access ~~said the~~ at least one physical device, ~~the said~~ executing section ~~sends is~~ operable to send an error message to the application program.

12. (Currently Amended) The contention arbitration apparatus according to claim 10, wherein when an access indication is provided by an application program[[,]] which is not allowed to access ~~said the~~ at least one physical device since access to ~~said the~~ at least one physical device is granted to another application program, ~~the said~~ executing section ~~sends is~~ operable to send an error message to the application program.

13. (Currently Amended) The contention arbitration apparatus according to claim 1, wherein upon receipt of an access termination indication from ~~said the~~ at least one application program, ~~the said~~ resource access determining section ~~grants is~~ operable to grant an access right to another application program which attempts to use the functions associated with the resource and ~~updates~~ update the resource information such that a result of the grant of the access right is reflected in the resource information; and

wherein ~~the said~~ device access determining section ~~determines is~~ operable to determine whether ~~said the~~ another application program is able to access ~~said the~~ at least one physical device based on the resource information updated by ~~the said~~ resource access determining section.

14. (Currently Amended) The contention arbitration apparatus according to claim 13, further comprising:

an application information storing section for storing, as application information, a correspondence between a determination result obtained by ~~the said~~ device access determining section and the plurality of application programs; and

an executing section for updating the application information based on the determination result obtained by ~~the said~~ device access determining section.

15. (Currently Amended) The contention arbitration apparatus according to claim 13, further comprising an executing section for changing a setting of a device driver when ~~the~~ said device access determining section determines that ~~said-the~~ another application program is able to access ~~said-the~~ at least one physical device, the setting being changed such that ~~said-the~~ another application program is allowed to access the at least one physical device.

16. (Currently Amended) The contention arbitration apparatus according to claim 1, wherein when only ~~said-the~~ at least one application program, which specifies the logic device, is allowed to use the functions associated with all the resources associated with the logic device, ~~the~~ said device access determining section ~~determines-is operable to~~ determine that ~~said-the~~ at least one application program is allowed to use ~~said-the~~ at least one physical device.

17. (Currently Amended) The contention arbitration apparatus according to claim 1, wherein when only ~~said-the~~ at least one application program, which specifies the logic device, is associated with a part of the resources associated with the logic device, ~~the~~ said device access determining section ~~determines-is operable to~~ determine that ~~said-the~~ at least one application program is allowed to use functions defined by the part of the resources when accessing ~~said-the~~ at least one physical device.

18. (Currently Amended) The contention arbitration apparatus according to claim 1, further comprising an application I/F section for accepting a specification of the logic device from ~~said-the~~ at least one application program.

19. (Currently Amended) The contention arbitration apparatus according to claim 1, wherein the resource information contains additional information which indicates for each resource whether to grant an access right to an application program having provided an access indication first or last; and

wherein ~~the~~ said resource access determining section ~~determines~~ is operable to determine which application program is granted the access right based on the additional information.

20. (Currently Amended) A contention arbitration program, stored in a memory, for causing a computing apparatus to arbitrate an access contention caused when a plurality of application programs simultaneously attempt to access at least one physical device, the computing apparatus having stored therein resource information which indicates a correspondence between at least one resource, which defines functions of ~~said~~ the at least one physical device, and at least one application program, which is allowed to use functions associated with ~~said~~ the at least one resource, and also having stored therein device information which indicates a correspondence between a logic device, which defines functions specified by ~~said~~ the at least one application program which attempts to access ~~said~~ the at least one physical device, and ~~said~~ the at least one resource which defines functions required for implementing functions defined by the logic device, ~~the~~ said contention arbitration program causing the computing apparatus to perform a contention arbitration method comprising ~~the steps of~~:

recognizing a resource associated with the logic device specified by ~~said~~ the at least one application program by reference to the device information;

determining, by reference to the resource information, which application program is allowed to access the recognized resource; and

determining, based on a determination result obtained ~~by the step of~~ in said determining, by reference to the resource information, which application program is allowed to access the recognized resource, whether the application program which has specified the logic device is able to access ~~said~~ the at least one physical device which implements the functions defined by the logic device.

21. (Currently Amended) A contention arbitration method for causing a computing apparatus to arbitrate an access contention caused when a plurality of application programs, stored in a memory, simultaneously attempt to access at least one physical device, the computing apparatus having stored therein resource information which

indicates a correspondence between at least one resource, which defines functions of ~~said~~ the at least one physical device, and at least one application program, which is allowed to use functions associated with ~~said-the~~ at least one resource, and also having stored therein device information which indicates a correspondence between a logic device, which defines functions specified by ~~said-the~~ at least one application program which attempts to access ~~said-the~~ at least one physical device, and ~~said-the~~ at least one resource which defines functions required for implementing functions defined by the logic device, ~~the~~ said contention arbitration method comprising ~~the steps of~~:

recognizing a resource associated with the logic device specified by ~~said-the~~ at least one application program by reference to the device information;

determining, by reference to the resource information, which application program is allowed to access the recognized resource; and

determining, based on a determination result obtained ~~by the step of in said~~ determining, by reference to the resource information, which application program is allowed to access the recognized resource, whether the application program which has specified the logic device is able to access ~~said-the~~ at least one physical device which implements the functions defined by the logic device.